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QUALITY ASSURANCE PROJECT PLAN  
FOR  
EPA REGION V SUPPORT  
OF THE ATSDR  
MULTISTATE LEAD EXPOSURE STUDY

Approved:

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9,18,91

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- \* Any environmental measurements and samples collected prior to this approval date, were done at the discretion of the Remedial Project Manager and subject to on-site field audit verification, and appear to be collected using the same procedures as are approved herein.

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Table of Contents

	<u>Page#</u>
I. Project Description.....	3
II. Project Organization.....	4
III. Data Quality Objectives.....	6
IV. Sampling Protocols.....	7
V. Sample Receipt and Custody.....	11
VI. Analytical Methodology.....	12
VII. Data Reduction and Validation.....	12
VIII. Data Reporting.....	12
IX. Quality Control Checks.....	13
X. Performance and Systems Audits.....	13
XI. Preventive Maintenance (PM).....	13
XII. Analysis of QC Data.....	13
XIII. Corrective Actions.....	14
Attachments: Appendix A - Field Sampling Protocols	
Appendix B - Region 5 SAS Requests	

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## **I. Project Description**

Granite City, Illinois is the location of a former secondary lead smelting facility. Metal refining, fabricating, and associated metal processing activities have been conducted at the site since 1903. From 1903 to 1983, secondary smelting occurred on-site. Secondary smelting facilities included a blast furnace, a rotary furnace, several lead melting kettles, a battery breaking operation, a natural gas-fired boiler, several baghouses, cyclones and an afterburner. Most (85 percent) of the air samples taken from Granite City between 1978 and 1981, as part of IEPAs newly instituted air quality testing for lead, showed lead levels higher than levels the federal government considers safe. Metallic pollutants, which have been dispersed throughout the environment in Granite City and the surrounding areas, have heavily contaminated soil in the study area. It is likely that uptake of metallic pollutants by plants and animals, including humans, has occurred. The Agency for Toxic Substances and Disease Registry (ATSDR) has provided funding to the State of Illinois to conduct a comprehensive blood lead/urinary cadmium study on a representative number and distribution of eligible residents nearby the site. The study will include the collection of samples from potential study will include the collection of samples from potential environmental sources of lead and cadmium: soil, house dust, drinking water and indoor paint, from all participant households.

The objectives of the overall study are defined in the ATSDR study protocol (Draft; Summer, 1991; pages 8 and 9). Of the seven objectives listed, the objectives to which EPA participation will contribute are:

"To determine the level of environmental lead and cadmium contamination found in target areas and compare them with levels of contamination found in comparable non-target areas."

"To determine the extent to which environmental, behavioral, occupational, and socio-economic factors influence exposure to lead and cadmium in target and non-target populations."

"To determine the extent to which exposure has occurred in populations living in areas with both mining and industrial emissions compared to populations living in areas with industrial emission only."

In order to contribute to meeting these goals, EPA will collect environmental samples at the residences of selected study

participants, as discussed in section IV.A.2, below. Of special interest in the study will be households with children between 6 and 71 months of age.

The specific objectives of EPA participation in the study will be:

1. Collection of representative samples of house dust, drinking water, and play area soil, and in-situ analysis of paint by XRF for Pb (Paint is not considered a major exposure route for Cd), from a randomly selected subset of study participant residences.
2. Provision of data to ATSDR for determination of the probability that a statistically significant relationship, if any, exists between the environmental lead levels in the four sampled media and the human exposure data.

Environmental sampling in this study will be performed by the U.S. EPA Region V contractor, Ecology and Environment (E&E). Environmental samples will be sent by E&E to a CLP lab for analysis. E&E will report analytical results to U.S. EPA Region V. This document describes the procedures and activities which will be applied to such samples.

## **II. Project Organization and Responsibilities**

A. Pat Van Leeuwen, toxicologist, WMD/OSF/TSU, will have the responsibility for maintaining overall communication with ATSDR and the Illinois Department of Public Health and for providing input on questions having toxicological aspects.

Brad Bradley, Remedial Project Manager, WMD/OSF/IL/IN Section, will be the EPA contact to E&E, which will perform project sampling, and will provide input on questions having technical aspects.

B. The Illinois Department of Public Health (IDPH) shall, through designated representatives, interface with Mr. Bradley to provide listing of names, addresses, and telephone numbers of all households where environmental sampling is to occur. Identification and notification of households with children exhibiting elevated blood lead or urinary cadmium levels shall be the responsibility of IDPH.

C. As noted above, environmental sampling in this study will be performed by the USEPA's contractor, Ecology and Environment. The

contractor, in accepting the assignment to support this Study, agrees to perform sampling activities as outlined in this Plan and in conformance with applicable Region V CLP SAS - and E & E field SOPs as approved for their Region V ARCS Contract, and other guidance which may be provided by EPA for performance of Study-related activities.

D. Sample receipt, storage, handling, and custody within the laboratory will be the responsibility of the selected CLP laboratory.

E. The selected CLP laboratory will receive and analyze the environmental samples and report analytical results to Region V representatives, following procedures outlined in this Plan.

F. Final data review and validation will be the responsibility of E&E.

G. Transmittal of reviewed and validated data on disk to U.S. EPA Region V will be the responsibility of E&E.

H. Transmittal of final data in a brief report to U.S. EPA Region V will be the responsibility of E&E.

I. Brad Bradley will be responsible for the dissemination of applicable environmental data to the appropriate entities in the State of Illinois, for responding to questions from the State, and for addressing public questions relating to the study from the Federal perspective.

J. ATSDR will assume final Federal responsibility for the Study data because of the greater protection of individual privacy afforded ATSDR data bases; EPA final data is subject to FOIA request actions. ATSDR will perform statistical review of the environmental data vis-a-vis human exposure data. All study data shall be made available to EPA upon request, for purposes such as evaluating the Pb uptake/biokinetic model.

K. Program and field sampling QA/QC oversight will be the responsibility of E&E.

### **III. Data Quality Objectives**

A. The data quality objectives (DQOs) for this project are to generate data that are of sufficient quality to enable the objectives of this project to be met. The sampling and analytical methods selected for this project (SOPs are referenced elsewhere) are consistent with these objectives in terms of accuracy, precision, and representativeness. Of the quantitative DQO components, the quantity of data, or completeness, is typically based on assumptions regarding the statistical variability of the study population to be sampled. For this project there are insufficient data available to make these assumptions with any degree of confidence. Precision and Accuracy objectives for the study data are consistent with those specified in the SAS requests (Appendix B).

B. An additional completeness goal for the laboratory will be the generation of useable analytical data for at least 95% of the samples received in acceptable condition. This means that out of the total amount of data that might potentially be generated for all samples analyzed, no more than 5% of the data will be unusable due to failure to meet analytical accuracy, precision, or detection limit goals stated in the referenced SASs, caused by analytical problems such as matrix interferences, or problem such as laboratory accidents, holding times or preservation violations, etc.

C. To minimize variability in the data reported as part of the Study, it is incumbent upon field samplers and their supervisors to become familiar with all sampling guidelines and procedures included herein or referenced, so as to ensure that the data reported from this Study will represent the overall environment from which the analyzed samples are taken. Any sub-sampling procedures performed in the laboratory will be done in accordance with the SAS requests.

D. To insure the comparability of data produced for this Study to that produced under other plans or studies, EPA accepted sampling and analytical methods, as documented in SOPs referenced herein, will be used whenever possible. All SOPs referenced are available in the E&E ARCS contract QAPP and Appendix A.

E. Method detection limits are dependent upon the specific properties of, and interferences present in, a given sample, and so may not always be achieved. Detection limit goals are to be one tenth the action levels specified in the table below for both metals in various media.

These detection limits will permit evaluation of field sample data against the following limits, so as to determine whether the samples are above background levels with a 95% confidence level.

Sample Medium	Action Level	
	Lead	Cadmium
House Dust	500 ug/g	136 ug/g
Paint	0.7 mg/sq.cm.	N/A
Drinking Water	15 ug/L	5 ug/L
Play Area Soil	500 ug/g	136 ug/g

Note the detection limits of one-tenth the action levels noted may not be achieved if the minimum sample amounts discussed in Section IV, Sampling Protocols, are not collected. Also, available analytical methods may not permit analysis of Cd in water at concentration as low as 0.5 ug/L. A detection limit of 2.0 ug/L will be acceptable for lead in water.

#### IV. Sampling Protocols

##### A. Environmental Sampling Design Considerations

###### 1. Selection of Residences to be Sampled:

- a. In order to meet the Study goals outlined above, EPA Region V will collect environmental samples: soil, house dust, drinking water and paint, from all households in the Study area at which biological sampling is scheduled. In order to identify high biomedical metal levels, an action level of 10 ug/dL of Pb in blood and/or 8 ug/L Cd in urine will be used.
- b. Environmental sampling will be conducted at all households where biomedical testing occurred. The names, address, and telephone numbers of residences to be sampled shall be forwarded to EPA by IDPH as soon as practicable. EPA plans to perform environmental sampling in one sampling event which is scheduled to begin the first week of September, and will last approximately four weeks.

- c. Residential environmental sampling will be conducted as summarized in the table below:

Sampling Area	Total Households in study	# of Sampled Households
Granite City and the adjacent areas of Madison and Venice, IL	250	100% of homes
Control area - Pontoon Beach, IL	250	100% of homes

**B. Pre-Sampling Verification Interview and Briefing**

Prior to sampling, the IDPH will contact the study households to obtain access agreements for environmental sampling. IDPH shall then forward the names, addresses, and telephone numbers of households to be sampled to the EPA, which shall forward appropriate information to E&E.

If possible, E&E shall confirm sampling plans with a given household within one week of the scheduled sampling event. Upon arrival, the E&E sampling teams will briefly speak with the homeowner or other adult resident about the purpose and nature of the visit, and provide them with information written by ATSDR, to include telephone contacts for additional information.

If for some reason a household cannot be sampled (e.g. one is home), an attempt to reschedule sampling will be made.

**C. Sample Collection, Documentation, and Handling**

1. Sampling Number System: All samples will be assigned a unique identification number according to Region V CLP protocol. EPA will report data to ATSDR using such identification numbers, along with sufficient documentation for ATSDR to correlate the data with biomedical metal levels in study participants, and any other data collected by ATSDR or IDPH. All analyses shall be performed "blind" by the CLP laboratory staff; correlation or analytical data with site location information shall be performed after the analytical results are complete, as part of generating the final report to be forwarded to other project participant organizations.

2. Sample Containers: Sample containers and associated supplies will be obtained by E&E and prepared and utilized per Region 5 SARA Sample Handling Manual or E & E SOPs, with the exception that one liter poly bottles will be used for the collection of water samples.

3. Sample Collection Procedures:

Note: See the attached Appendix A, which shall supercede the language below in the event of any inconsistencies.

One field duplicate sample will be collected for every ten field samples of drinking water, soil and house dust.

- a. Drinking Water samples will be collected in accordance with Appendix A: all samples of drinking water will be first-draw samples, as specified in the EPA's Final Rule for Lead and Copper in Drinking Water, Federal Register, June 7, 1991. These samples may be collected by the residents in sample containers without appropriate preservatives, supplied by E&E in advance, and picked up at the time of the dust, soil and paint sampling. Alternatively, E&E may choose to send a sampler first thing in the morning to all residences to be environmentally sampled that day to draw the samples, after pre-arranging with the residents so that the water is not turned on prior to sampling. Either method is acceptable, but the method chosen must be applied consistently to all residences sampled during the project, and the choice of method must be documented in writing by E&E in the final project report. E&E will acid preserve these samples at the end of each day's activities.

One field blank (deionized water) will be submitted blind for laboratory analysis at a frequency of one in each set of twenty field samples.

- b. Indoor House Dust: field sampling personnel will collect residential dust samples from primary play areas (areas most likely to impact on a child's hands or result in ingestion during indoor activity). A minimum of three areas should be sampled: at the main entrances to the household, and two additional areas most likely to be use by children in the household for play areas. Additional areas for sampling may include secondary entrances to the home (back or side doors), dust on window sills, furniture, and carpet in additional play areas or areas of frequent activity by the children. Bedroom, Kitchen, and living room floor samples will be collected first, followed by floor samples from the entry way. Finally, samples from window wells will be collected.

Once the individual sampling areas are determined, they should be noted on the sampling sheets, including the total area sampled for the household. One composite sample of dust will be taken and analyzed per household.

Vacuum equipment to be used will be equipped with a pre-weighed glass fiber filter (the weight of each filter will be noted in indelible ink on its zip-lock by the laboratory prior to shipment to the field) to trap the dust. The filter will be removed between residences and placed in a zip-lock bag for laboratory analysis. Alternatively, a modified portable "dustbuster" type vacuum cleaner may be used (Sirchee-Splittler method), with the dust removed after sampling each residence and placed in a zip-lock bag. Other necessary sampling equipment are zip-lock baggies containing pre-weighed filters with the weight noted on the bag in indelible ink, and a cylinder of compressed air to decontaminate sampling equipment.

- c. Indoor Paint: Indoor paint shall be analyzed in-situ by a portable X-Ray Fluorescence (XRF) instrument, operated per manufacturer's instructions. Measurements will typically be made in play areas below three feet in elevation from the floor, indoor walls, door frames, window sills, and banisters, with special attention given to areas indicating peeling or chipped paint, or evidence of chewing on the surface by the resident children. A minimum of five locations will be measured and recorded on the field sheets. The condition of each painted surface sample will be noted on the field sheets by the instrument operator. The mean of the several individual readings will be reported as the paint lead value for the residence. Additional information is provided in Appendix A.
- d. Play Area Soil: Field sampling personnel will identify play areas on the property used by children in the household through information available from the previous household survey (area census), pre-sampling questions of the residents, and visible signs of use (e.g. bare soil under a swing set). For each site a site sketch will be made on the sampling form indicating the position of the main building and any other buildings such as sheds or garages, paved areas, and play areas.

A representative number of such location(s), comprising not less than ten aliquots, will be proportionally sampled based on their relative areas and apparent degree of use; these are then composited to produce the one sample forwarded to the lab representing the entire play area. Exact locations to be sampled at a given residence will be chosen per the professional judgement of the sampling team leader, and will be fully documented on the field sheets. A corer shall be used to sample the top one inch of soil. Debris and leafy vegetation will be removed from the top of the core, but not soil or decomposed matter; this part of the soil sample is likely to be the highest in metal contamination. Samples will not be taken from locations within one foot of the house foundation per story of the residence unless there is clear indication such areas are in use as play areas, as chipped or peeling exterior paint may produce a typically high readings in such locations.

4. Field Sample Documentation:

- a. Field Sheets: Field sheets per SARA Sample Handling Manual or E&E SOPs shall be used to document locations and times of sampling, as well as all other appropriate details. In particular, sketches should be made of the locations sampled, especially dust and soil samples taken in the play areas, as noted above. E&E shall retain field sheets until instructed otherwise by EPA.
- b. Sample Chain of Custody: Sample chain-of-custody forms will be prepared per E&E SOPs.

D. Sample Delivery

All samples to be analyzed under this play will be delivered to the CLP Laboratory in accordance with E&E SOPs or Region 5 SARA Sample Handling Manual. Each set of samples will be delivered along with appropriate field documentation, Chain-of-Custody forms, and "Analytical Services Request Form(s)".

V. Sample Receipt and Custody

- A. Immediately upon receipt of Study samples the CLP personnel will unpack and inspect the shipment, sign the Chain of Custody form, initiate appropriate internal tracking records, and store the samples in a secure area. If inspection of the shipment causes either the integrity or condition of the samples to be questioned (e.g. samples not cooled, broken containers, etc.), such observations will be noted on the

Chain of Custody Record and brought to the attention of the Region 5 RSCC or SAS Request Contract.

- B. The CLP lab personnel or other appropriate personnel will be responsible for the custody, storage, handling, and disposal of all samples received for analysis under this plan.
1. Prior to analysis all non-aqueous samples received for analysis under this plan will be stored at ambient temperature. All aqueous samples will be stored per CLP SAS protocols.
  2. Samples will be analyzed and the data will be reported within sixty days of receipt of the samples. Digestates will be disposed upon completion of data review and approval.
  3. Approval must be granted before the required analyses may be considered to be complete for each sample. Such approval will be based upon the report of complete and appropriate data, as described in the SAS Request.

#### **VI. Analytical Methodology**

- A. Preparation and analyses of the samples collected in this Study will be performed according to SAS Requests (Appendix B). Use of GFAA or ICP will be necessary to meet the required levels of accuracy, precision, and sensitivity (detection limits) noted above. Laboratory Quality Control shall be performed per SAS Requests data will be reviewed according to CLP Functional Guidelines for Evaluating Inorganics Data.

#### **VII. Data Reduction and Validation**

- A. The reporting units and data reduction procedures used will be those specified in the action level table in Section III.E above. The data will be reviewed per CLP Functional Guidelines for Evaluating Inorganics Data, with this document being the basic reference for data usability.

#### **VIII. Data Reporting**

After data review, reduction, and validation, as a primary deliverable, a disk or "tape" of the data shall be supplied to EPA within 120 days of the completion of the field sampling operations,

for transmittal to ATSDR. A draft report summarizing the environmental data collected and an evaluation of the quality of such data shall be supplied to EPA within 150 days of the completion field sampling operations, for transmittal to the individual(s) noted in Section II above. The report will include statements that samples do or do not meet applicable criteria as spelled out in this document and applicable SOPs. Following receipt of U.S. EPA and ATSDR comments on the draft report, a final report shall be submitted to Brad Bradley within 30 days.

**IX. Quality Control (QC) Checks**

- A. The laboratory QC procedures are incorporated into specific methodologies referenced in Appendix B, SAS Requests.
- B. Field QC will include 10% duplicates (of each matrix), and 5% field blanks (at least one per day).

**X. Performance and System Audits**

Neither field audits nor laboratory audits beyond the routine QA/QC oversight of the appropriate supervisors is anticipated for this project, unless specifically determined to be necessary.

The CLP lab audits are the responsibility of EMSL - LV and Region 5, CRL. Field audits are the responsibility of the RPM, CRL and CDO.

**XI. Preventive Maintenance (PM)**

Lab preventive maintenance will be performed in accordance with manufacturer's specifications and applicable laboratory policies and SOP's.

Field - XRF - per manufacturer's specifications.

### **XII. Analysis of QC Data**

All QC data will be reviewed by E&E personnel using the calculations and statistical methods specified in Region V protocols. This review will include an evaluation of accuracy, precision, completeness, sample representativeness, and comparability, using the methods discussed in Section IX., Internal Quality Control Checks, above.

### **XIII. Corrective Actions**

All questionable data will be tracked by the analyst at the CLP lab to identify potential out-of-control situations. When an out-of-control situation is identified, it will be addressed per resolution with the SAS request contract or Region 5 RSCL.

## **APPENDIX A: FIELD SAMPLING PROTOCOLS**

Note: In the event of inconsistencies between the following protocols and the QAPP, the protocols shall govern.

Preparation for the environment sample collection begins at the field office. The environmental team will be given an assignment for the morning or the entire day. Once the assignment is received, the environmental team members will check the accuracy and completeness of the data on each environmental sample form. The Dwelling ID Number and other identifying information should be on all the environmental forms.

The environmental team will then calibrate the Paint XRF instruments (Princeton Gamma-Tech XK-2 or XK-3). Either the Princeton Gamma-Tech XK-2 or the XK-3 instruments, or both, will be used. Both instruments operate on the same principle. The newer model, the XK-3 is capable of reading only to a maximum of 10 mg Pb/sq. cm. Paint in the older housing may have higher concentrations of lead, thus, when monitoring teams visit older housing, i.e., those built before 1940, the XK-2 should be used, if available. If the XK-2 is not available, an attempt should be made to extrapolate values greater than 10 mg Pb/sq.cm. with the XK-3.

After the necessary calibration of equipment, the environmental monitoring team should make certain that all equipment and supplies are ready for use.

All members of the team should wear appropriate identification.

Exterior and interior samples will be collected. Exterior samples to be collected are soil samples. The interior samples and information to be collected is as follows:

- 1) Collection of tap water samples.
- 2) Sketching a floor plan of the residence.
- 3) Collection of interior surface dust samples.
- 4) Screening for lead in painted surfaces; walls and trim, avoiding metal doors outlets, etc.

### **I. Soil Sample Collection**

The Primary method of determining the lead content of the soil will be by acid digestion and graphite furnace atomic absorption spectrometry.

### **A. Site Description**

For each location, a detailed drawing should be made that shows the boundary of the lot, the position of the main building and any other buildings such as storage sheds or garages, the position of the sidewalks, driveways, and other paved areas, the position of the play areas if obvious, and the position of the areas with exposed soil (grassy or bare), roof rain spouts and general drainage patterns.

In addition to the diagram, briefly describe the location, including the following information:

- Type of building construction (brick, wood, etc- 1 or 2 story)
- Condition of main building
- Condition of property (debris, standing water, vegetation cover)
- Presence and type of fence
- Animals on property
- Apparent use of yard (toys, sandbox, children present)
- Location of 10 soil aliquots

### **B. Sample Collection**

Sample Collection shall be performed as outlined in the QAPP, with the exception that all aliquots will be of equal volume and will be mixed in a stainless steel bowl prior to packaging. Assemble composite soil core segments in 8 ounce glass jars suitable for prevention of contamination and loss of the sample. Record the sample identification number on the bag and the sample record sheet. Store the composite soil sample at ambient temperature until submitted to the laboratory for analysis.

Clean the corer after collecting each sample composite by reinsertion of the corer into the soil of the next sampling area.

### **C. Sample Handling and Storage**

Seal the sample jars to prevent loss or contamination of the sample and store samples in a dry location at ambient temperature.

Record-keeping and Sample Custody: Initiate soil sample records for each location. Record sample numbers on location diagram, soil area description, and sample record sheet. Send the sample to the laboratory and release the sample to the laboratory personnel for analysis.

## II. Surface Dust Collection

### A. Sample Collection

A portable "dustbuster" type vacuum cleaner will be used; due to the sample size required, the Sirchee-Splittler modified dustbuster will not be used. Use a new bag for each household, to avoid cross-contamination. In order to ensure that the sample size is sufficient, either weigh the sample using a field scale or collect a large enough sample to ensure that three to five grams of dust have been collected.

### B. Sample Areas

The interior surface dust sample will consist of a composite of sub-samples taken from the following areas in the residence:

Entry (E): A floor area inside the residence directly adjacent to the main entry to the residence.

Floor (F): At least 3 floor areas which should include but are not limited to a sample from a high-traffic area in the main living area and a sample from the child's bedroom. If carpet is present in the residence it shall be the first choice of sample area. If carpet is not present, a mixture of non-carpet floor areas will be sampled.

Window (W): At least three window areas (window sills and window wells), including but not limited to a window in the main living area and a window in the child's bedroom.

The main entry sample is collected from the floor close to the entry door. The entry mostly used by the family should be used. The identification of sample sites from the most frequently occupied room and the child's bedroom will be determined partly by the floor covering present in those rooms. If the floor is carpeted, a larger sample can readily be collected from almost any pathway in the room. A pathway might consist of an area immediately inside of a doorway into the room or an obvious pathway from one side of the room to the other. In rooms where there is no carpeting, the most likely place to find an adequate supply of surface dust would be an area immediately adjacent to a wall. For each floor surface, an approximately one meter square area should be vacuumed. Additional living areas (e.g. additional floor areas, around furniture, etc.) Should be vacuumed, if necessary, to obtain an adequate sample size. In no event shall dust be obtained from household areas where dust generally collects for long periods of time, such as behind

major appliances, under beds, etc.

The sample sequence should be as follows: collect the bedroom, kitchen and living room samples first. Then, collect the floor sample from the entry way. Then, collect the window well samples. Finally, if necessary, collect the samples from additional living areas.

**C. Sketch of Residence**

In order to more fully describe where samples have been collected, a top view of the residence will be made by the sampling crew. This sketch should show the primary features of the residence, including a north arrow indicator and the relationship of the various rooms to each other. The sampling areas should also be indicated. Rooms should be labeled according to their apparent function.

**III. Water Sampling**

Residents will be provided with clean, capped bottles and instructed to collect water on the day of scheduled environmental sampling. The sampling team or its manager should give the following instructions to the resident who will collect the sample:

The tap water sample should be taken from the cold water faucet of the kitchen. It should be a first flush sample of water that has been standing in the pipes from 6 to 18 hours. There are two options for the time a sample is taken: (1) it can be taken first thing in the morning, or (2) if all of the residents of the household have been out of the house for the entire day, it can be taken at the end of the day (i.e. dinner time). Labelled plastic bottles will be provided for the sample. The bottle should be completely filled with water. The sampling team will pick up the sample at a convenient time on the day of scheduled environmental sampling.

Before dropping off a water collection bottle, the appropriate member of the sampling team will fill out and affix the label provided. The chain of custody form will be initiated when the collectors pick up the water sample. Region V will record pH and conductivity prior to acidifying the sample.

At the end of each collection day, water samples will be acidified with nitric acid, per required protocol. After the addition of the nitric acid to the water sample, the initials of the person adding the acid to the sample and the time and date will be recorded. In no event will the nitric acid preservative be provided to the residents. Nitric Acid (1:1) will be added to reach pH<2.

## **WATER SYSTEM EVALUATION**

An evaluation will be made of the plumbing under the kitchen sink in order to determine the composition of water lines servicing the kitchen sink. The water supply beneath the kitchen sink generally consists of hot and cold water pipes coming from either the wall behind the sink or, occasionally, up through the floor into the cabinet beneath the sink. These supply lines generally terminate at shut-off valves beneath the sink. The supply lines continuing from the shut-off valves are generally of different material than the supply lines going to the shut-off valves.

Supply lines in residential construction can be copper, galvanized, PVC, or lead pipe. PVC pipe is easily identified because of its plastic composition. Copper pipe can be identified by scraping the surface corrosion from the pipe to reveal the bright copper color. Galvanized pipe can be recognized by the threaded fittings if present and visible or by the hard surface of the pipe. Lead pipe can be recognized by the softness of the material. It is easily bent into shape and can be scratched with a knife blade or other hard tool. When scratched, the exposed surface is silvery in color.

The supply lines running from the shut-off valves to the sink generally are copper, chrome-plated brass or PVC. The PVC is easily recognized because of its plastic composition. Chrome-plated brass is also easily recognized because of the shiny surface. Copper can be identified by scratching the surface to reveal the copper color. Identifying the composition of the plumbing system beneath the sink completes the evaluation of the plumbing system. All information should be recorded.

### **IV. Paint Sampling Protocol Using an XRF Analyzer**

#### **A. Background and Selection of Surfaces**

The concentration of lead in paint will be determined by using an X-ray fluorescence analyzer. Two types of instruments may be used, the XK-2 or the XK-3, both manufactured by Princeton Gamma-Tech, Inc. The XK-3 with a range of 0-10 mg of Pb per  $\text{cm}^2$  will be the primary instrument used. If available the XK-2 will be a backup and also used in the event a reading on the XK-3 exceeds 10 mg/sq  $\text{cm}^2$ .

In each residence two surfaces, a painted woodwork and a painted walls in each of three rooms or areas most frequently occupied by the subject child will be evaluated (e.g. child's bedroom, kitchen, living room). One reading will be taken at

three different locations on each type of surface. The identity of the rooms and the Pb found in the paint will be recorded. In addition, a copy of a floor plan of the

residence will be available to the technician and on which the sample location will be noted. All unpainted surfaces, such as paneling, wallpaper, and unpainted woodwork will not be tested. In the event a room selected is unpainted an alternate room will be selected and this information recorded.

In order to characterize the paint and surfaces in a given room at least one painted wall and one painted trim in the room (door or window sill) should be screened. When screening the woodwork, three separate readings will be taken at three different locations on the woodwork. A similar procedure will be used for screening painted walls within a room. One reading will be taken on each of three separate wall areas, either on the same wall or on different walls within a room. If all walls are painted the same color, then the three readings can be taken from one wall. If the walls are painted different colors, then a reading from the different colored walls should be included. Whenever changing areas or locations, one reading should be taken to clear the machine prior to taking the actual reading to be recorded. The arithmetic mean of the eighteen readings should be recorded as the reading for the house. Each individual reading will also be recorded to provide data for future follow-up actions, if necessary.

XRF readings will be taken by placing the instrument on the designated surface and opening the shutter. (More accurate readings can be obtained from flat surfaces so curved surfaces will be avoided). Once the shutter is opened the lead content of the paint will appear as a visual numerical display on the instrument. The operator will read the number for the other team member to record. This will be repeated back to the operator.

In addition to the paint lead screening, the environmental monitors will make an evaluation of the condition of painted surfaces. This evaluation will be a rating scale of 1 to 4:

- 1) Intact
- 2) Slightly Peeling
- 3) Moderate Peeling
- 4) Extremely Deteriorated

**B. Operation of the XRF Analyzer to Determine the Concentration of Lead**

At the start of each day the performance of the XRF instruments are evaluated using standard procedures. Prior to

taking readings at the residence, calibration checks will occur using reference material (1.5 mg/cm<sup>2</sup> Pb and a Zero Check) prepared by the Department of Housing and Urban Development. After the designated areas in the home have been sampled and before the team is ready to leave, the instrument's calibration will once again be checked. All calibration information should be added to the FORM 07 XRF Lead Paint Screening work sheet, if available, or equivalent form. The HUD Guidelines for Lead in Paint, Sept 19, 1990 (Revision 3) are followed.

Following is the Operating Procedure for the XK-3 unit:

1. Remove the battery pack, coiled cable, and XK-3 unit from the carrying case.
2. Connect the battery pack to the XK-3 unit, using the coiled cable.
3. Locate the LOCK SWITCH underneath the handle toward the rear of the unit and push it forward. A red light over the display window will now glow to indicate that the instrument is ready to perform its analysis as soon as the shutter is opened.
4. Depress the RED RESET button on the back plate of the unit, just above the coiled cable connection, and hold for 8-10 seconds.
5. Grasping the wooden handle, position the face-plate of the instrument against the surface to be measured and push down firmly and evenly on the handle to spring the shutter open. The red light over the window will now blink to indicate that the shutter is open and that the measurement is taking place. As soon as the shutter opens, the previous read-out in the window vanishes, leaving the window blank except for a single decimal point.
6. Keep the handle firmly depressed until the new read-out appears.
7. When the new read-out appears, release pressure on the handle. The display window retains read-out until the handle is pushed down again to begin another measurement.
8. Push the lock switch back to the lock position when readings are completed.
9. If the calibration check results exceed  $\pm 0.02$  mg/cm<sup>2</sup>, the instrument RESET is pushed before continuing. The XK-3 is calibrated by the manufacturer.

**APPENDIX B**  
**SAS REQUESTS**